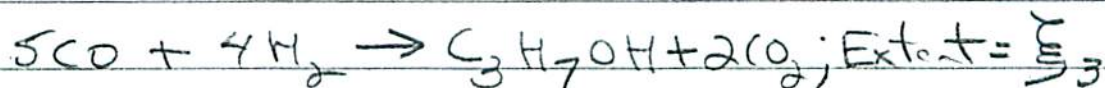
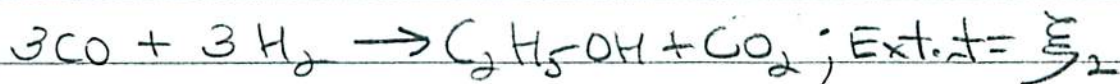
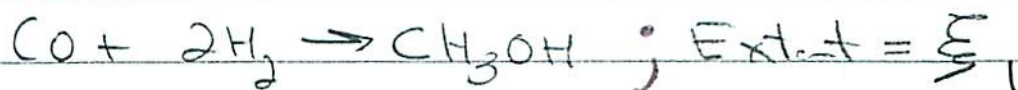


Solution to S-6

Problem 1-5

Reactions:



Stoichiometric Table

<u>Species</u>	<u>In (mol/hr.)</u>	<u>Out (mol/hr.)</u>
CO	100	30
H ₂	100	30
CO ₂	0	F _{CO₂}
CH ₃ OH	0	F _{MeOH}
C ₂ H ₅ OH	0	5
C ₃ H ₇ OH	0	F _{PrOH}

Law of Definite Proportions:

$$\Delta N_i = N_{i,\text{out}} - N_{i,\text{in}} = \sum_{k=1}^3 \nu_{ki} \xi_k$$

or,

$$\Delta F_i = F_{i,\text{out}} - F_{i,\text{in}} = \sum_{k=1}^3 \nu_{ki} \xi_k$$

units of
mol/hr.

For C₂H₅OH:

$$5 - 0 = (0) \xi_1 + (1) \xi_2 + (0) \xi_3$$

$$\boxed{\xi_2 = 5}$$

For H_2 :

$$(30 - 100) = (-2)\xi_1 + (-3)\xi_2 + (-4)\xi_3$$

$$-70 = -2\xi_1 - 3 \times 5 - 4\xi_3$$

$$2\xi_1 + 4\xi_3 = 55 \quad (A)$$

For CO :

$$(30 - 100) = (-1)\xi_1 + (-3)\xi_2 + (-5)\xi_3$$

$$-70 = -\xi_1 - 3 \times 5 - 5\xi_3$$

$$\xi_1 + 5\xi_3 = 55 \quad (B)$$

Solving A & B simultaneously, $\boxed{\xi_1 = 9.17, \xi_3 = 9.17}$

For CO_2 :

$$F_{CO_2} - 0 = (1)\xi_2 + (2)\xi_3 = 23.33$$

$$\boxed{F_{CO_2} = 23.33}$$

For CH_3OH :

$$F_{MeOH} - 0 = (1)\xi_1; \quad \boxed{F_{MeOH} = 9.17}$$

For C_2H_5OH :

$$F_{PrOH} - 0 = (1)\xi_3; \quad \boxed{F_{PrOH} = 9.17}$$

Filling in the "Out" column of the Stoichiometric Table

<u>Species</u>	<u>Out (mol/hr)</u>	<u>y (mole fraction)</u>
CO	30	0.281
H ₂	30	0.281
CO ₂	23.33	0.219
CH ₃ OH	9.17	0.086
C ₂ H ₅ OH	5.0	0.047
C ₃ H ₇ OH	9.17	0.086
	<u>106.67</u>	<u>1.000</u>